TF10398 Tunable Notch Filter

Features

High Stop-Band Rejection

Absorptive Design

Can be Cascaded for Multiple Notches

On-device Temperature Measurement

Compact Form-factor

Control and Power over USB 2.0

Applications

Jamming Mitigation

Communications Receivers

ESM Receiver Protection

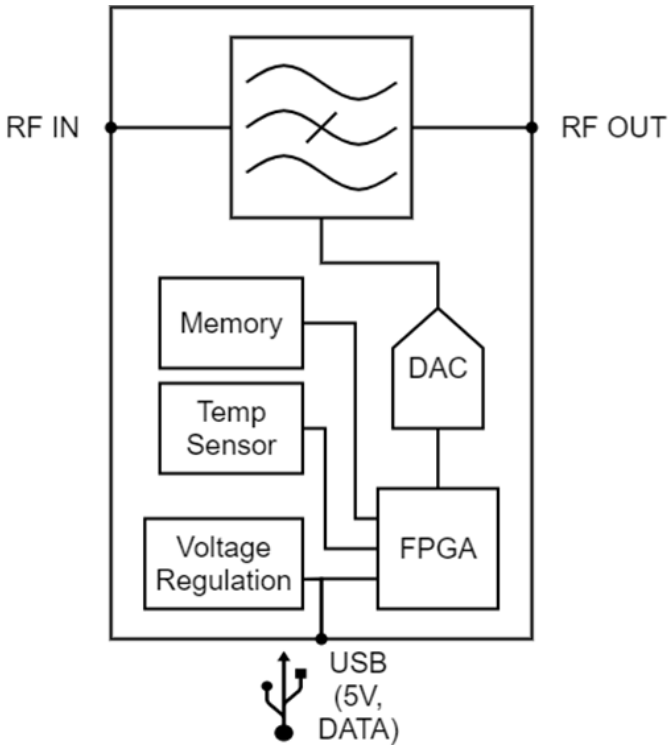
TR Modules

Electronic Warfare

General Description

TF10398 is a unit for a high-rejection, tunable, absorptive notch filter that is designed and packaged to make evaluation and testing straightforward. The unit can be controlled through the provided graphical user interface or python API.

Functional Block Diagram



Electrical Specifications

Parameter	Symbol	Specification	Conditions
Tuning Range	Fc	108 to 199 MHz	Band 1
		200 to 350 MHz	Band 2
		390 to 720 MHz	Band 3
Tuning Resolution		1 MHz typical	All bands
Rejection		25.7dB min, 62.8dB max	Band 1
-3dB Bandwidth		19.3 MHz min, 20.7 MHz max	
-20dB Bandwidth		1.9 MHz min, 2.4 MHz max	
Rejection		21.3dB min, 62dB max	Band 2
-3dB Bandwidth		22.1 MHz min, 24.5 MHz max	
-20dB Bandwidth		2.3 MHz min, 3.1 MHz max	
Rejection		33.5dB min, 72.3dB max	Band 3
-3dB Bandwidth		70.5 MHz min, 87.6 MHz max	
-20dB Bandwidth		9.1 MHz min, 14.9 MHz max	
Passband Frequency Range		100 to 1000 MHz	All bands (See Note 1)
Insertion Loss	IL	2.2dB maximum	All bands (See Note 2)
Return Loss		9.4dB min, 26.8dB max	Band 1 (See Note 3)
		7.9dB min, 70.3dB max	Band 2
		5.8dB min, 15.1dB max	Band 3
Group Delay		12.71ns maximum	20MHz spacing from notch center frequency
Tuning Speed		20µs	All bands, Full Scale (See Note 4)
IIP3		34.32dBm typical	Passband 2-Tone Test (See Note 5)
Passband RF Power		+30dBm	
Notch RF Power		-15dBm	
Supply Voltage		5V	USB
Minimum Signal to Notch Spacing		Half Maximum 3dB Bandwidth	

Temperature

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Operating Temperature	OTR	-40		+60	°C	
Storage Temperature	STR	-40		+60	°C	

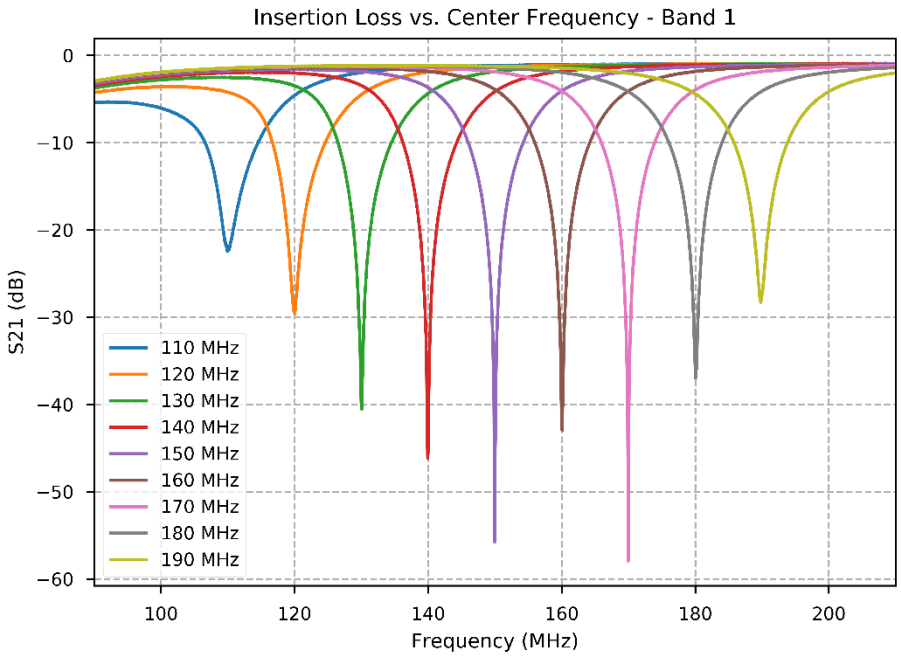
Hardware Interface

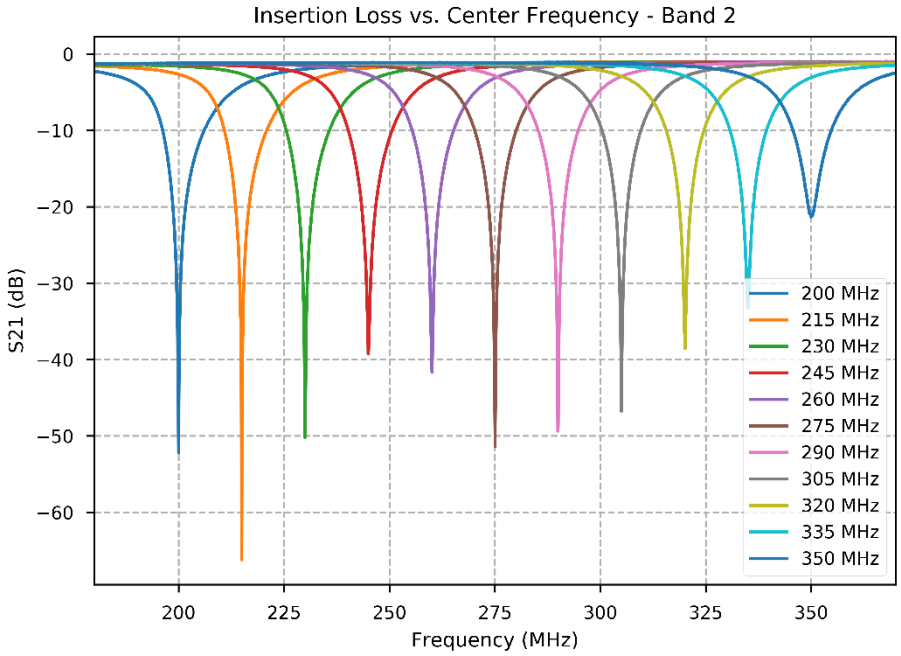
Name	Type	Hardware	Manufacturer	Manufacturer PN#
RF1	RF Input/Output	SMA Female	Amphenol RF	132146
RF2	RF Input/Output	SMA Female	Amphenol RF	132146
Power/Control	USB	USB Mini-B	Amphenol ICC	MUSB15104

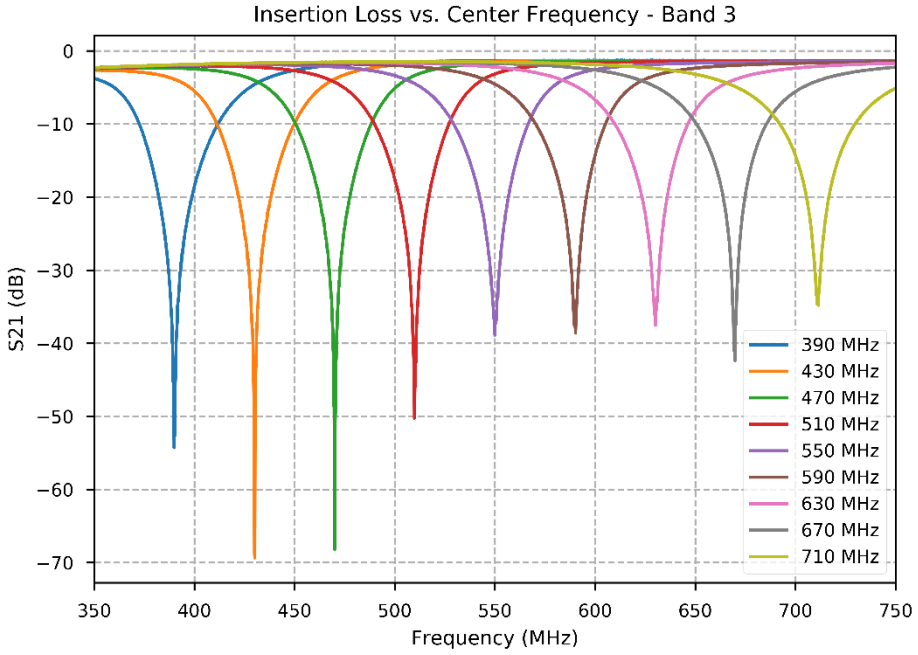
Notes

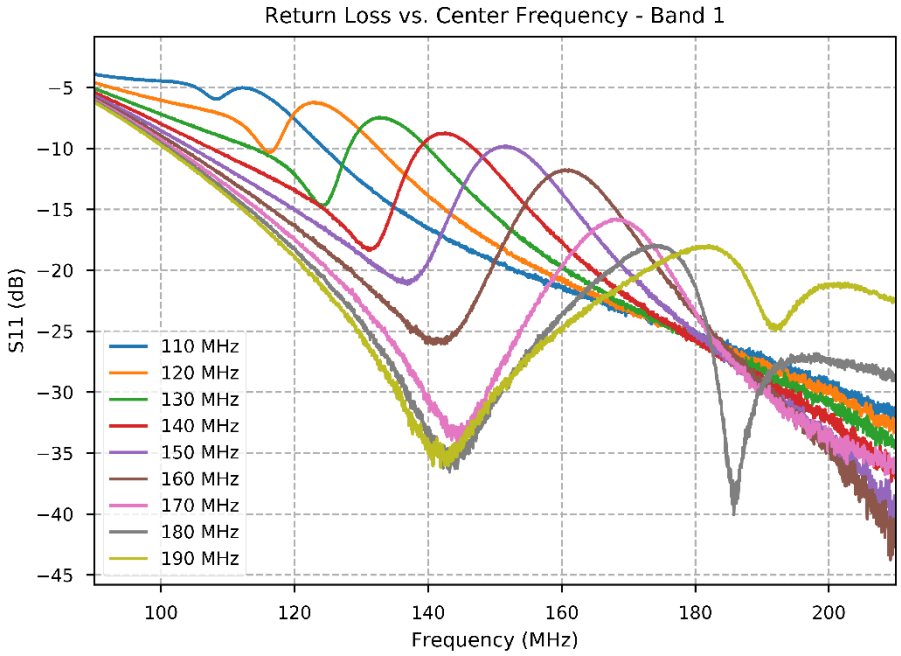
Note 1	Passband is defined as the frequency range between the 3 dB insertion loss points outside of the notch filter tuning range.
Note 2	Filter insertion loss is defined as the maximum insertion loss within the passband of the notch filter tuning range.
Note 3	Maximum return loss in the passband frequency range outside of the notch.
Note 4	Tuning speed is approximated for this unit. Actual tuning speed of the filter will depend on voltage driver and control interface latency.
Note 5	IIP3 is determined using the fundamental tone in the passband and the highest 3rd order product produced. Tone spacing of 0.5 MHz was used.

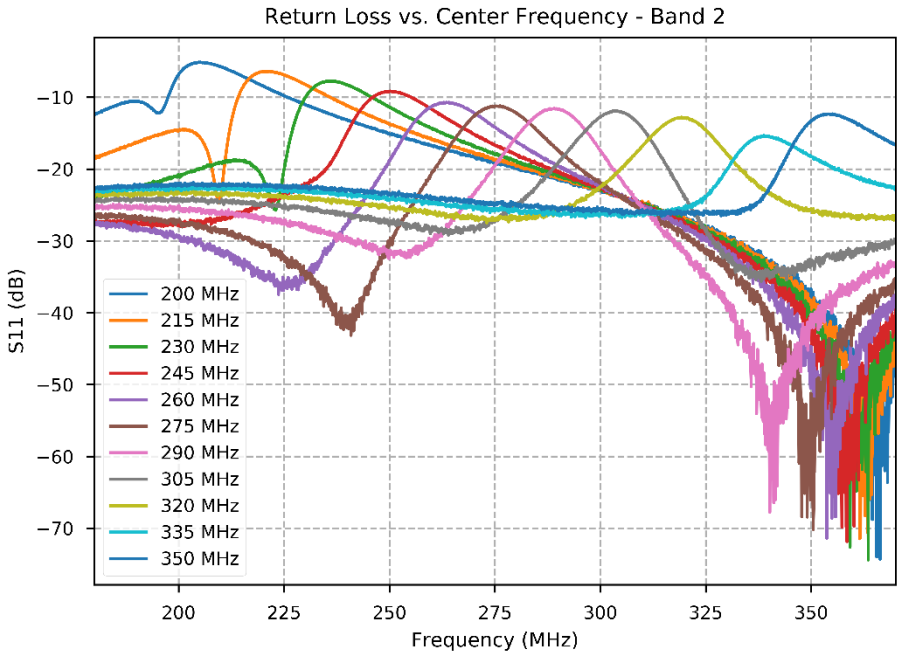
Simulation plots

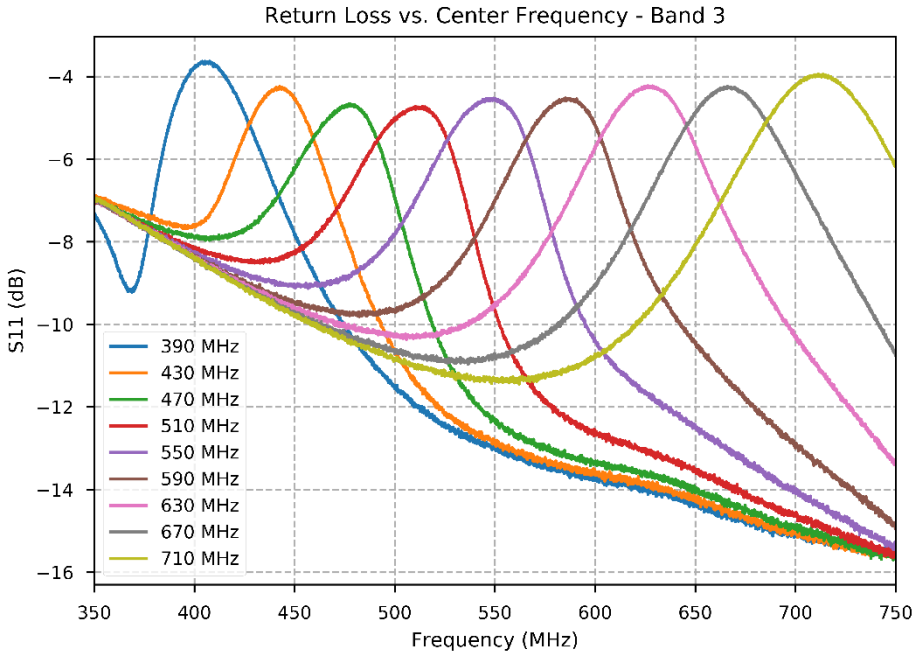


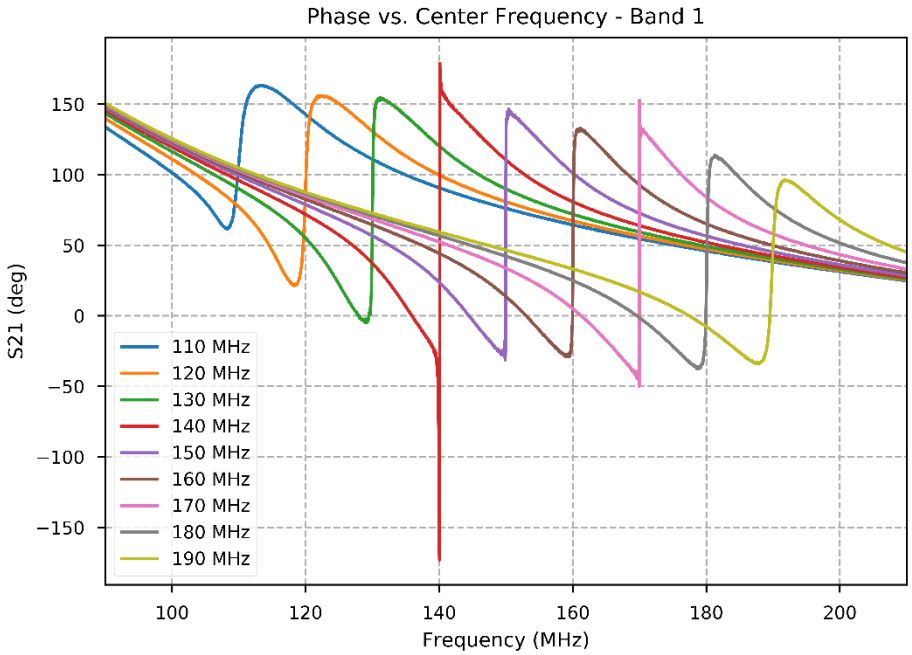

Insertion Loss vs. Center Frequency - Band 2
S21 (dB)
0
−10
−20
−30
−40
−50
−60
200
225
250
275
300
325
350
Frequency (MHz)
200 MHz
215 MHz
230 MHz
245 MHz
260 MHz
275 MHz
290 MHz
305 MHz
320 MHz
335 MHz
350 MHz

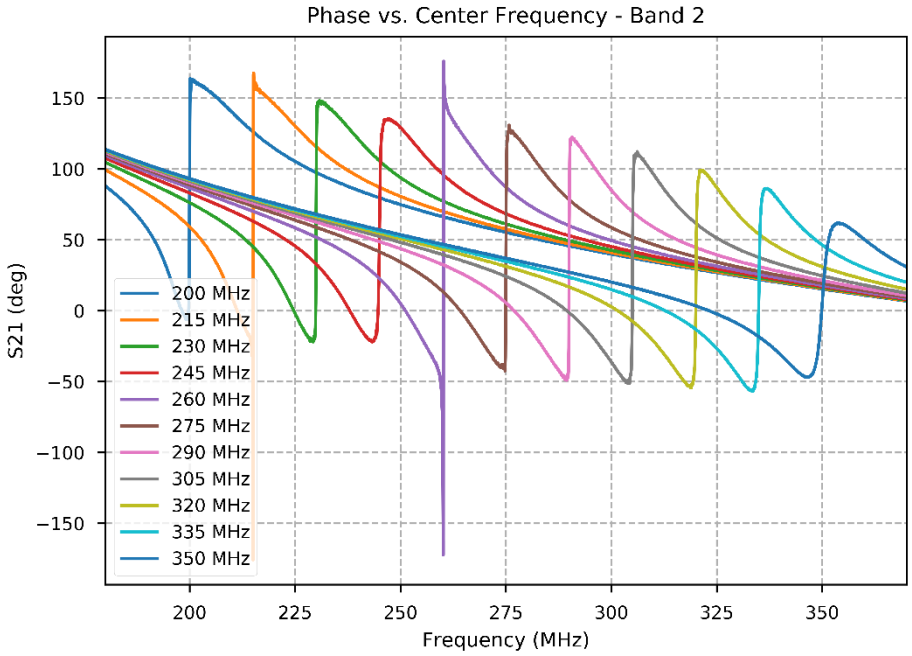

Insertion Loss vs. Center Frequency - Band 3
S21 (dB)
0
−10
−20
−30
−40
−50
−60
−70
350
400
450
500
550
600
650
700
750
Frequency (MHz)
390 MHz
430 MHz
470 MHz
510 MHz
550 MHz
590 MHz
630 MHz
670 MHz
710 MHz

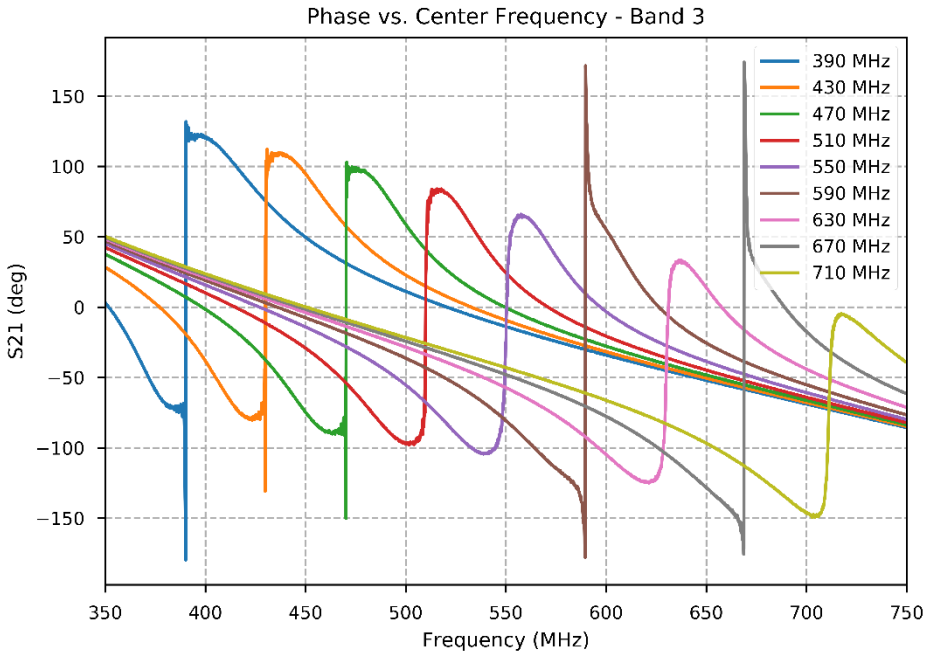

Return Loss vs. Center Frequency - Band 1
S11 (dB)
−5
−10
−15
−20
−25
−30
−35
−40
−45
110 MHz
120 MHz
130 MHz
140 MHz
150 MHz
160 MHz
170 MHz
180 MHz
190 MHz
100
120
140
160
180
200
Frequency (MHz)

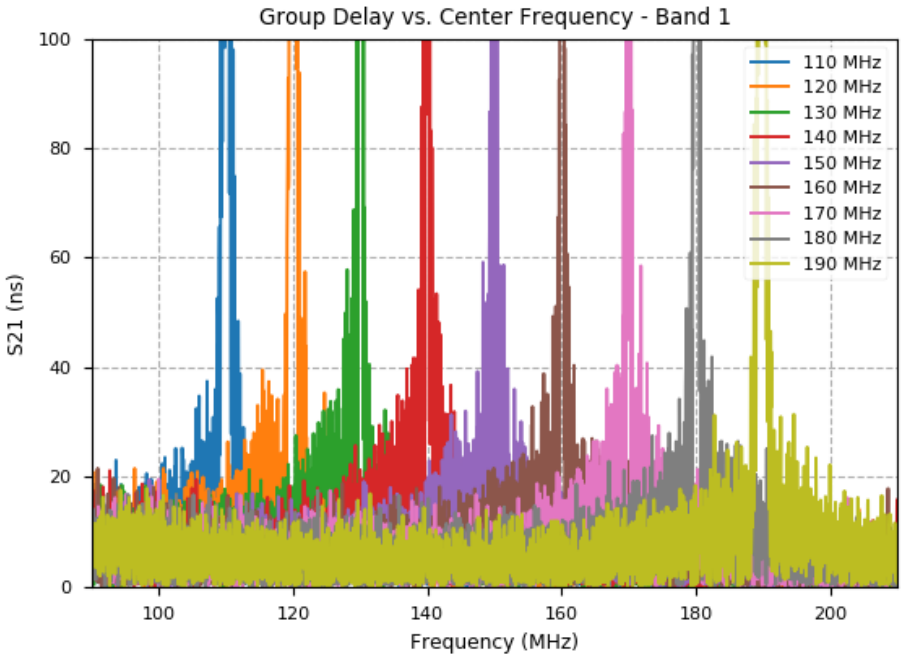

Return Loss vs. Center Frequency - Band 2
S11 (dB)
−10
−20
−30
−40
−50
−60
−70
200 MHz
215 MHz
230 MHz
245 MHz
260 MHz
275 MHz
290 MHz
305 MHz
320 MHz
335 MHz
350 MHz
200
225
250
275
300
325
350
Frequency (MHz)

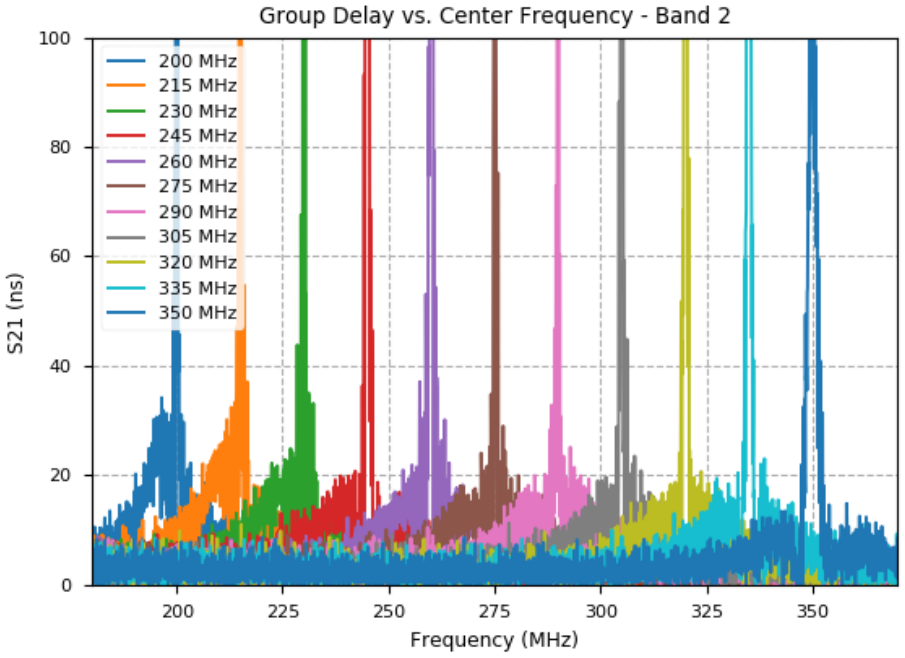

Return Loss vs. Center Frequency - Band 3
S11 (dB)
−4
−6
−8
−10
−12
−14
−16
350
400
450
500
550
600
650
700
750
Frequency (MHz)
390 MHz
430 MHz
470 MHz
510 MHz
550 MHz
590 MHz
630 MHz
670 MHz
710 MHz

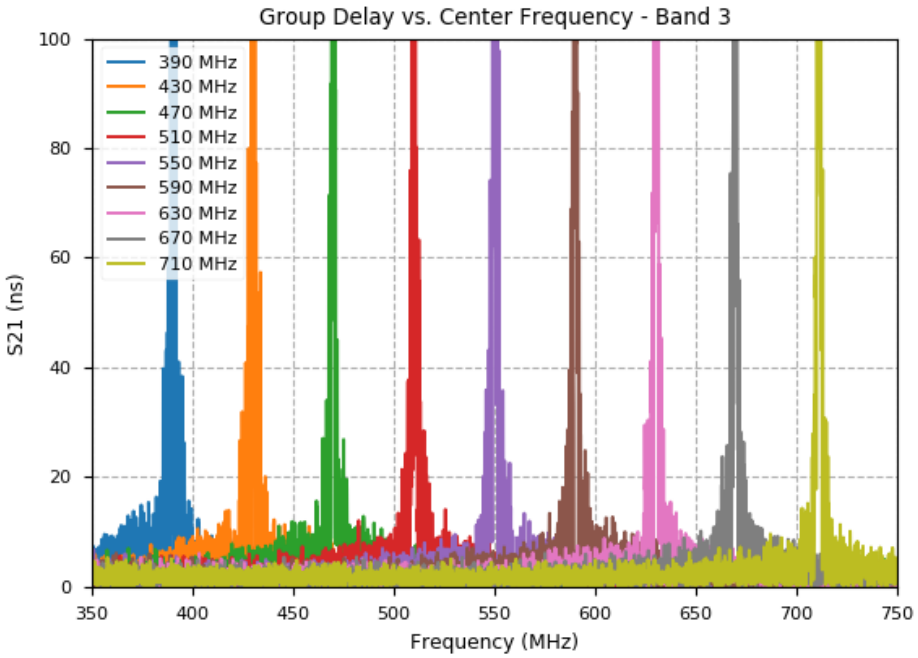

Phase vs. Center Frequency - Band 1
S21 (deg)
150
100
50
0
−50
−100
−150
100
120
140
160
180
200
Frequency (MHz)
110 MHz
120 MHz
130 MHz
140 MHz
150 MHz
160 MHz
170 MHz
180 MHz
190 MHz


Phase vs. Center Frequency - Band 2
S21 (deg)
Frequency (MHz)
200 MHz
215 MHz
230 MHz
245 MHz
260 MHz
275 MHz
290 MHz
305 MHz
320 MHz
335 MHz
350 MHz


Phase vs. Center Frequency - Band 3
S21 (deg)
Frequency (MHz)
390 MHz
430 MHz
470 MHz
510 MHz
550 MHz
590 MHz
630 MHz
670 MHz
710 MHz

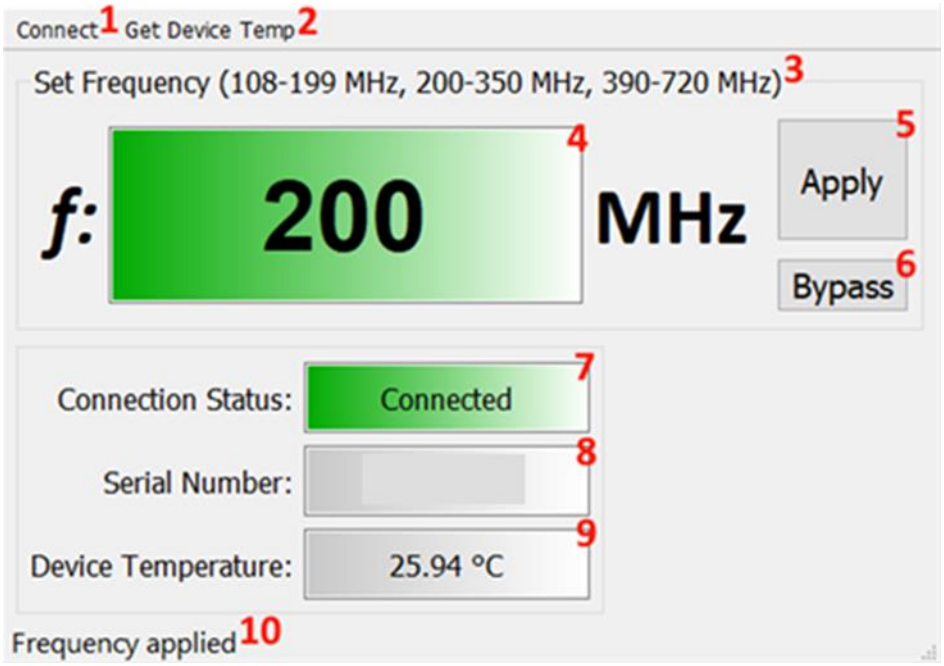

Group Delay vs. Center Frequency - Band 1
S21 (ns)
Frequency (MHz)
110 MHz
120 MHz
130 MHz
140 MHz
150 MHz
160 MHz
170 MHz
180 MHz
190 MHz


Group Delay vs. Center Frequency - Band 2
S21 (ns)
Frequency (MHz)
200 MHz
215 MHz
230 MHz
245 MHz
260 MHz
275 MHz
290 MHz
305 MHz
320 MHz
335 MHz
350 MHz


Group Delay vs. Center Frequency - Band 3
S21 (ns)
Frequency (MHz)
390 MHz
430 MHz
470 MHz
510 MHz
550 MHz
590 MHz
630 MHz
670 MHz
710 MHz
0
20
40
60
80
100
350
400
450
500
550
600
650
700
750

Filter Control Software

The Tunable Filter unit is provided with control software for ease of testing. To run, connect the filter and the provided USB thumb drive to the same Windows machine. Launch *TunableFilter.exe*. The user interface is detailed below:

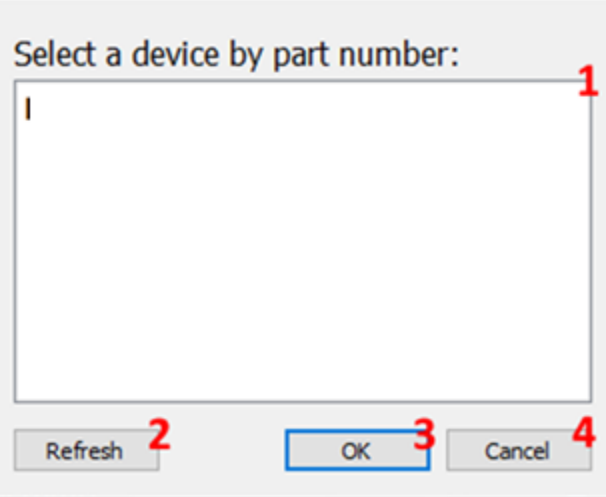


Index	Name	Function
1	Connect Button	Opens the connection browser (see Figure 8, Table 5)
2	Get Temperature Button	Reads device temperature and updates respective field
3	Frequency Tuning Range(s)	Tuning range and resolution of filter. [1]
4	Frequency Input Field	Field to type desired frequency setpoint
5	Apply Frequency Button	Applies frequency typed in Frequency Input Field. [2]
6	Bypass State Enable	Applies Bypass (all-pass) state to filter, if applicable. [3]
7	Connection Status	Shows status of connection to Tunable Notch Filter
8	Connected Device PN	Shows Part Number of connected Tunable Notch Filter
9	Connected Device Temperature	Shows last read Device Temperature. [4]
10	Status Bar	Temporarily shows relevant messages and errors

Notes

Note 1	Some devices have multiple ranges of valid tune states. Values between listed ranges are invalid (e.g., 375 MHz in the example). Bounds of listed ranges are

	inclusive.
Note 2	Pressing ENTER also applies the value in the Frequency Input Field.
Note 3	Not all devices have a bypass state. The button is unavailable in this case.
Note 4	Device temperature is read on initial connect but will only update when Get Device Temp is pressed.

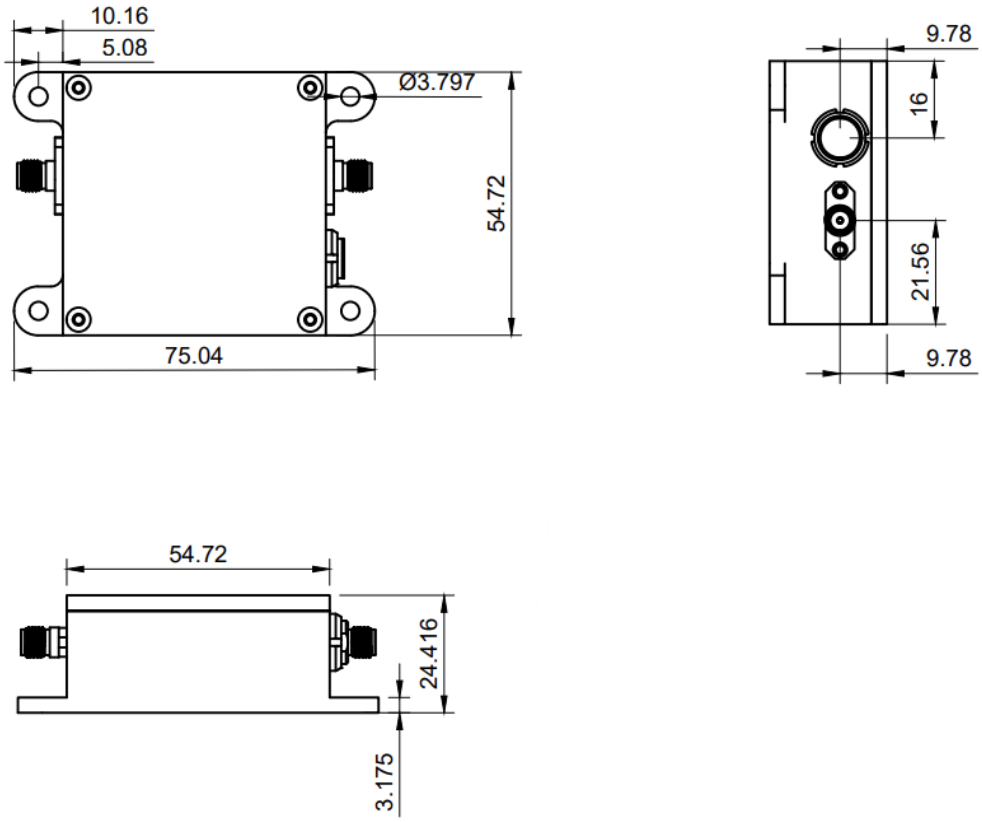


Index	Name	Function
1	Discovered Device List	Shows a list of all discovered Tunable Notch Filters.
2	Refresh List Button	Re-searches for available Tunable Notch Filters and updates list.
3	OK Button	Connects to selected part number. [1]
4	Cancel Button	Cancels connection attempt and closes browser. [2]

Notes

Note 1	Desired Part number must be highlighted in the list when pressed. Double-clicking desired serial number also initiates connection.
Note 2	Equivalent to closing window with X button.

Outline Drawing



All units in mm

Revision History

Date	Rev	Author	Details of Revision
07-22-25	A	AR	Added outline drawing
04-16-25	0	AR	Initial Version